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ABSTRACT

A pilot study was conducted of the understanding of prospective elementary school teachers of mathematical concepts. Purposes were to test the diagnostic instrument used to measure comprehension of concepts and to determine whether American College Test mathematics scores of student teachers could be used to predict ability to understand concepts used in new math in the elementary school. Ss were 46 student teachers to whom the Modern Mathematics Understanding Test, Multilevel Education was administered. ACT scores were available for 30 of the 46. Results showed that: (1) the test can be used to determine their ability to understand modern math concepts if some modifications of its use are made; (2) ACT scores cannot be used to predict understanding of modern math concepts; (3) some student teachers do not have an adequate understanding of informal geometry; (4) some student reachers need more practice writing alternative forms of mathematical sentences and testing their truth value; and (5) Ss performed best on basic operations, but some need additional instruction in applying mathematical principles in problem-solving situations and some lack an understanding of fractions and percent. (KM)

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CAN ACT SCORES BE USED TO PREDICT PROSPECTIVE ELEMENTARY TEACHERS' ABILITY TO UNDERSTAND CONCEPTS USED IN NEW MATHEMATIC CURRICULA?

by

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Mathematics educators (Grossnickle, 1951) have long recognized that a major deterrent to improving instruction in mathematics in the elementary school was the teacher's lack of mathematical background. Prior to the introduction of new mathematics, recommendations for improving teacher-education mathematics programs were made but very little change took place. When the new and strange elements in content appeared in modern mathematics it became apparent that the need for additional mathematical knowledge was necessary. (Ruddell, Dutton, Reckzeh, 1960)

In 1961 the teacher-training panel of CUPM prepared and published a report recommending a minimum of twelve semester hours be included in the elementary teacher-training programs with major emphasis on the real numbers, introductory algebra, and informal geometry, but only occasionally have such recommendations been implemented. Although some systems followed these recommendations the teachers of mathematics methods, supervisors and teachers who took the courses indicated that these college mathematics courses were inadequate. The inadequacies of these programs can be found in such publications as "The 1967 Report of the Cambridge Conference on Teacher Training," "Improving Mathematics Education for Elementary School Teachers, A Report of 1967 Conference at Michigan State," and the January, February, and March 1968 issues of The Arithmetic Teacher. Spitzer (1968) stated that this dissatisfaction warranted careful consideration. He further stated that students failed to see relationship between what they studied in these courses and what they would teach in the elementary school, even though the content of these mathematics courses was selected for its relevance to the K - 6 elementary mathematics program. He further stated that the reasons may be varied but the chief reason may be the manner it is

presented in either the text books or by the college instructor or both.

With this widespread concern for helping pre-service and in-service elementary school teachers acquire new mathematical knowledge, there has been few attempts to find out how much of the new mathematics curricula pre-service and in-service elementary school teachers understand.

A study was made and reported by Kipps (1968) on the in-service elementary teachers' ability to understand concepts used in new mathematics curricula. Analysis of textbooks in mathematics for grades 1 - 6 published since 1962, was made to compare types of materials used. The materials were grouped into four categories; (1) numbers, numeration and sets; (2) basic operations and applications; (3) algebra and logic; and (4) geometry, measurement and graphs. A diagnostic test of 47 items was constructed and tested, then it was administered to 310 in-service teachers representing many and varied school districts. The study helped to identify problems elementary school teachers were having as they dealt with new mathematics curricula and what help could and should be offered. As a result of the study one of the recommendations was that the kind and amount of mathematics offered by colleges and universities, and required for the elementary school teacher needed to be reexamined in the light of what teachers are now expected to teach. A further study of research relative to pre-service teacher training revealed that (Phillips, 1968) prospective teachers taught by content-methods approach achieved higher on tests of operational skilling, meaning and understanding, and vocabulary, than groups taught only content. Another study by Sassenrath (1968) indicated that groups taught by guided discovery or lecture did not differ in mean scores on the Mathematical Teaching Task measure.

Reys' (1968) study of the attitudes of prospective elementary teachers indicated that attitudes became more positive after completion of courses in content and methods but four-fifths of the sixty percent expressing favorable attitudes had developed this attitude before grade nine. Hurst (1968) studied the relationship between certain teacher-related variables and student achievement in the third-grade arithmetic and found that the more recently teachers had a mathematics course the lower the student achievement.

Rey's (1968) study of the mathematical competencies of elementary education majors revealed that they did gain significantly, but approximately fifty-five percent scored below the median for pupils in grades eight and nine completing algebra. The prospective teachers missed approximately forty percent of the items on the real number system, sixty-seven percent on statements, and eighty percent on functions and graphs. The survey revealed only limited attempts to find out how much of the new mathematics curricula prospective elementary teachers understood.

Since the College of Education at Louisiana State University in New Orleans graduates more certified teachers in elementary education than any of the other Universities and Colleges in the area, the University should concern itself with identifying problems pre-service elementary school teachers are having as they deal with new curricula in mathematics. It was assumed that an understanding of mathematical concepts is one of the necessary conditions to guarantee that the concepts can be adequately taught to pupils in the elementary schools. All students graduating with a major in elementary education are required to take a minimum of two 3 semester hour courses in modern mathematics and a 2 hour course in Methods and Material. Freshmen entering Louisiana State University in New Orleans are

encouraged to take Math 7 if their math scores on the American College Test fall below 18.

It was felt that before an extensive study was conducted that a pilot study should be made. One of the purposes of the pilot study was to test the diagnostic instrument used to measure comprehension of concepts so that modifications could be made for future use. A second purpose was to determine whether the American College Test (ACT) mathematics scores of the student teachers could be used to predict the prospective teachers' ability to understand concepts used in the new modern mathematics curricula. This could have an effect on the type of instruction and placement of students in the modern mathematics course. A third purpose of the study was to analyze the test items to determine which areas of weakness were most prevalent in the mathematical background of the student teachers. The results of this analysis may indicate areas of instruction that need emphasis or are lacking in the present mathematics program for elementary education majors.

The study was limited to forty-six student teachers who had completed the general education requirements in mathematics and the elementary mathematics methods and materials course. The Modern Mathematics Understanding Test, Multilevel Edition (grades 6-8) was used to test the student teachers' understanding of modern mathematics. The test was developed to evaluate understandings in three general areas of mathematics: foundations, arithmetic operations, and geometry and measurement. Four facets of understanding are tested in each area. These facets are knowledge and computation, elementary understanding, problem solving and application, and structure and generalization. The test includes forty-eight test items.

After proctoring the test and analyzing the test items certain parts of the test should be modified and additional test items need to be added. The test is multiple choice and students are allowed to find solutions using a worksheet before marking the answers on the answer sheet. Some test items may be correct on the answer sheet but the student did not apply the mathematical principle involved. In analyzing the content of the test all areas found in modern mathematics test are included even though limited in scope. A recommendation would be to have the students number the test items requiring computation on the worksheet and turn in the worksheet with the answer sheet.

Although forty-six student teachers took the test, ACT mathematic scores were available for only thirty of the prospective teachers. A correlation coefficient was computed between the ACT mathematics scores and the total test items that were correct. The correlation between ACT mathematics scores and the number of correct test items was .33 at the .5 percent level of confidence. The correlation coefficient indicated a definite but small relationship existed between ACT scores and the mathematics test scores.

An analysis of the test items was made to determine the items that thirty percent or more of the student teachers missed. Sixty-four percent of the student teachers were unable to identify the measurements needed to find the area of a given parallelogram not having right angles. Only forty-eight percent of the students were able to find the cost to cover an L shaped area when given the measurements in feet and the price per square yard. Forty-two percent identified a trapezoid as a parallelogram. Given the formula for the area of a triangle and a diagram of three triangles having the same base and height but different base angles, thirty-three percent failed to

recognize that the three angles had the same area.

In a problem solving situation requiring the multiplication of two four place numerals in which the algebraic generalization of the distributive law a(b + c) = ab + bc could be applied, three-eighths of the student teachers were unable to identify the correct answer. Of those students getting the correct answer observation indicated that only a limited number applied the distributive law. When the student teachers had to identify the statement that was always true for all real numbers for three unknowns when written in a mathematical sentence using an inequality sign, thirty percent marked the incorrect answer. When given the matematical sentence (A * B) * C = A * (B * C), thirty-one percent of the students were unable to identify how often the sentence would be true if the given symbol was replaced by +, -, x or ÷ . Thirty-three percent of the students were unable to identify the algebraic equation that would denote one unknown as being the reciprocal of another unknown. Thirty-five percent were unable to identify the correct number when a percent of that number was given. When required to identify two fractions which were not equivalent, thirty-five percent marked the wrong answer. Thirty-five percent were unable to identify the immediate numeral that followed a given two place numeral when the first place holder was the highest numeral contained in the given base.

The analysis revealed that the student teachers showed the greatest weakness in the area of informal geometry. This maybe attributed to the fact that no academic instruction at the college level was required. It was apparent from the test that the student teachers needed practice writing alternative forms of mathematical sentences and testing their truth values. This may indicate that a course in introductory algebra would have been beneficial for some of the student teachers. In the area of basic operations the student teachers

did best. There was a definite weakness in applying the laws and principles in problem solving situations. Some student teachers lacked the ability to recognize equivalent fractions or percent equivalents. Even though many elementary teachers may not teach the topic, the use of percent is a basic tool of evaluation.

Conclusions

The following conclusions are restricted to only the student teachers tested and should not be interpreted as being representative of the total group of elementary student teachers.

From the results of this investigation the following conclusions were made:

1. The Modern Math Understanding Test can be used to determine the student teachers' ability to understand concepts in the elementary modern matematics curricula if some modification of its use are made.

2. The mathematic scores of the student teachers and their performance on the test indicate a definite but small relationship. The ACT mathematics scores can not be used to predict the understandings of modern mathematics concepts the student teachers will acquire in their academic training.

3. Some student teachers do not have an adequate understanding of informal geometry. Additional instruction in this area would be profitable to the student teachers.

4. The study further revealed that some student teachers need more practice writing alternative forms of mathematical sentences and testing their truth value. A course in introductory algebra would be beneficial.

5. The student teachers did best on basic operations. However, some need additional instruction in applying mathematical principles in problem solving situations. Also some lack an understanding of fractions and percent.

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